



Research on the Path of Improving Teaching Competence of Novice Young Teachers from the Perspective of AI Empowerment

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Abstract: Artificial intelligence technology has gradually penetrated the field of education, promoting the intelligent transformation of education. However, due to insufficient teaching practice experience, novice young teachers face problems such as inefficient knowledge system construction, difficulties in obtaining teaching resources, and a lack of teaching design experience throughout the entire process of lesson preparation, teaching, and evaluation, which hinder their professional development and role transformation. Although AI-assisted teaching tools provide technical support for solving these problems, novice teachers still face practical obstacles in their application, such as low usage rate, poor technical adaptability, cognitive bias, and lack of systematic support. This paper takes knowledge point organization and knowledge graph generation, course material collection and intelligent recommendation, and teaching design and intelligent lesson plan generation as core application scenarios, analyzes the application value, technical mechanisms, and practical cases of each scenario, explores effective paths for AI to assist novice teachers in teaching, helps novice teachers improve their classroom teaching, curriculum design, and human-machine collaboration capabilities, achieves the dual improvement of teaching practical ability and digital literacy, and provides practical reference and theoretical support for the professional development of novice teachers and the intelligent development of education.

Keywords: Artificial intelligence; Novice young teachers; Teaching dilemmas; AI-assisted teaching; Professional competence improvement

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1. Introduction

Since the launch of ChatGPT in 2022, generative artificial intelligence has entered the stage of large-scale application, gradually penetrating all aspects of education and teaching. While reconstructing teaching models, it has also brought new opportunities and challenges to teachers' professional development. As a new force in the teaching team, novice young teachers (hereinafter referred to as "novice teachers") have solid disciplinary theoretical foundations and work enthusiasm, but they face many growth dilemmas in the early stage of employment due to a lack of teaching practice experience.

Combined with the practical needs of novice teachers' teaching practice, their core pain points are concentrated in three aspects: first, it is difficult to quickly sort out textbook knowledge points and construct a systematic disciplinary knowledge system; second, resource retrieval and screening during lesson preparation is time-consuming and labor-

intensive, making it difficult to obtain high-quality resources that adapt to their own teaching needs and students' learning conditions; third, lack of teaching design experience makes it difficult to quickly form teaching plans that fit students' cognitive characteristics and conform to teaching laws. The information processing, knowledge organization, and content generation capabilities of artificial intelligence provide new paths for solving these pain points.

Based on this, this paper focuses on the core issue of "how artificial intelligence helps novice teachers carry out teaching efficiently", takes three core application scenarios as the entry point, sorts out the practical paths of AI-assisted teaching for novice teachers, analyzes the challenges in application and proposes optimization strategies, and provides support for the professional development of novice teachers and the intelligent development of education.

2. Practical dilemmas of novice young teachers in teaching practice and the current status of AI application

Novice teachers are an important reserve force for promoting high-quality education development, but in the early stage of teaching practice, they generally face multiple dilemmas that restrict teaching efficiency and professional development. Although artificial intelligence technology provides the possibility to solve these dilemmas, novice teachers still face many obstacles in AI application, showing the characteristics of "urgent demand but insufficient application, available technology but poor adaptability".

2.1. Core dilemmas of novice young teachers in teaching practice

The teaching dilemmas of novice teachers run through the entire process of lesson preparation, teaching, and evaluation, mainly reflected in three core links:

In the lesson preparation link, both knowledge system construction and resource acquisition have inefficiency problems. Although novice teachers have solid disciplinary knowledge, they lack experience in transforming fragmented knowledge into a structured teaching system. Facing textbooks, they find it difficult to sort out the logical connections between knowledge points quickly and cannot accurately grasp the key and difficult points of teaching, falling into the dilemma of "seeing the trees but not the forest"^[1].

In the teaching link, novice teachers lack experience in grasping learning conditions and designing classroom interactions. Due to inaccurate judgment of students' cognitive levels and learning styles, it is difficult to dynamically adjust teaching rhythm and strategies according to learning conditions. Classroom interaction forms are single, and students' enthusiasm cannot be effectively mobilized^[2].

In the evaluation and reflection link, there are problems of insufficient teaching feedback and a lack of a closed loop for professional development. Novice teachers lack efficient learning condition analysis tools and find it difficult to grasp students' learning situations fully. Homework correction and learning condition report writing are time-consuming and labor-intensive, and feedback content lacks pertinence and guidance^[3].

2.2. Current status and obstacles of artificial intelligence application in novice teachers' teaching practice

With the advancement of educational intelligence, the application of AI-assisted teaching tools has become increasingly widespread, but the AI application of novice teachers is still in the initial stage and faces multiple obstacles:

First, the application penetration rate is low, and the usage scenarios are limited. The application of AI teaching tools by novice teachers is mostly concentrated in basic links such as lesson plan generation and courseware production. The usage rate of deep application scenarios, such as knowledge graph construction, learning condition analysis, and personalized resource recommendation, is relatively low, failing to exert the full-process empowerment value of AI technology fully^[4].

Second, technical adaptability is insufficient and the user experience is poor. Some AI teaching tools have high

requirements for device performance and network environment. Novice teachers with poor network conditions or using old devices find it difficult to obtain a smooth user experience ^[5].

Third, application cognitive bias and role anxiety coexist. Some novice teachers have cognitive biases about the value of AI-assisted teaching. They either over-rely on AI tools and ignore their own leading role in teaching and professional judgment, or resist AI technology and generate professional anxiety due to fear of being replaced, which reduces their willingness to apply ^[6]. This cognitive bias makes it difficult for novice teachers to construct a scientific human-machine collaboration model, unable to fully exert the auxiliary role of AI, and even affects teaching quality and their own professional development ^[7].

3. Three key scenarios and implementation paths of AI-assisted teaching for novice teachers

The empowerment of artificial intelligence technology on novice teachers' teaching practice has been deeply integrated into all links of teaching activities (Figure 1). Combined with the typical pain points of novice teachers in the initial stage of their careers and the current status of AI education applications, knowledge point organization and knowledge graph generation, course material collection and intelligent recommendation, and teaching design and intelligent lesson plan generation are the three core scenarios with high technical maturity and outstanding application value at present.

These three scenarios do not exist in isolation, but respectively correspond to the three core tasks of novice teachers in the lesson preparation stage: knowledge system construction, teaching resource preparation, and professional plan design. They are interconnected and work together to form the key path for AI to assist the professional development of novice teachers. Compared with other AI application scenarios, these three scenarios are more in line with the urgent needs of novice teachers, have relatively moderate operation thresholds, and can be quickly transformed into teaching effectiveness, helping novice teachers quickly relieve lesson preparation pressure and make up for experience shortcomings. The following is a detailed analysis combined with the actual teaching situation of novice teachers from three aspects: application value, technical mechanism, and typical practice, taking into account both theoretical rigor and practical operability.

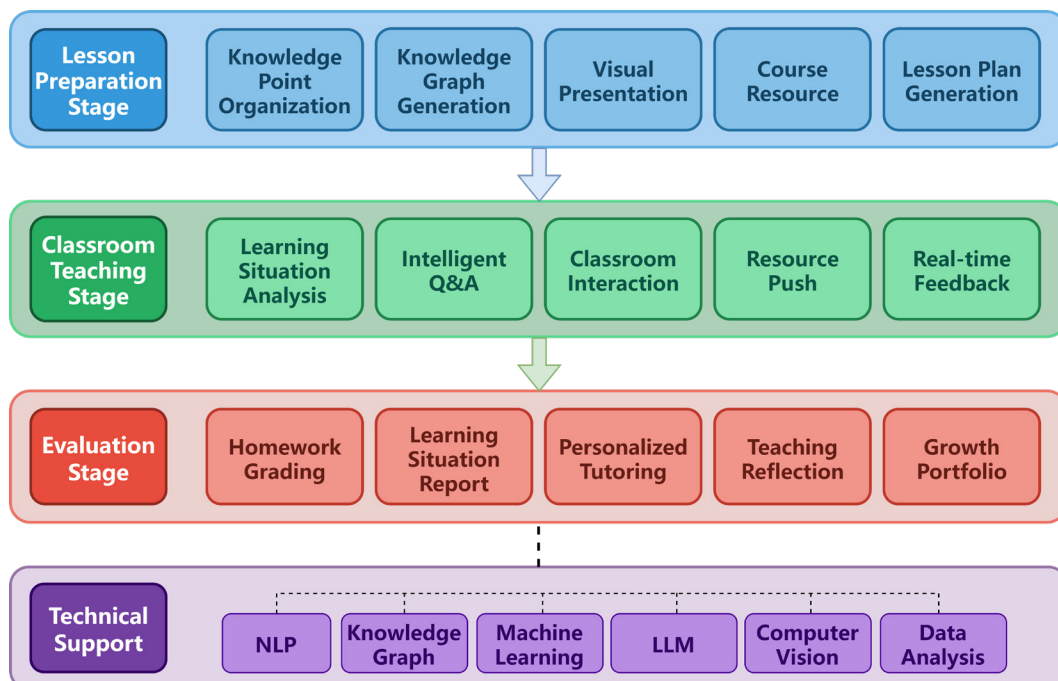


Figure 1. Functional framework of AI-assisted teaching.

3.1. Knowledge point organization and knowledge graph generation

3.1.1. Application value of knowledge graph in teaching

A knowledge graph organizes knowledge in a graph structure, uses nodes to represent core concepts, and edges to depict the logical relationships between concepts. It can intuitively present the hierarchical structure, correlation degree, and internal logic of knowledge points, providing a structured cognitive tool for teachers to grasp the disciplinary knowledge system and optimize teaching design.

For novice teachers lacking teaching experience, its value is particularly prominent: it can help novice teachers quickly establish an overall cognitive framework of disciplinary knowledge and solve the fragmentation dilemma; through visual presentation, it clearly highlights the key and difficult points of teaching and the connection between knowledge, guiding teaching time allocation and content focus; the structured knowledge network provides logical reference for teaching design, helping novice teachers construct teaching processes that conform to students' cognitive laws.

3.1.2. Technical path of AI-assisted knowledge graph generation

The current technical logic of AI-assisted teaching knowledge graph generation is divided into three progressive links (Figure 2): first, knowledge extraction and structured representation. AI relies on natural language processing technology to analyze textbook texts, extract core concepts, terms, and associated attributes from unstructured texts through named entity recognition, relationship extraction, and attribute extraction, and converts them into machine-understandable structured knowledge units; second, knowledge relationship modeling. Based on structured knowledge units, it identifies logical relationships such as synonymy, hyponymy, causality, and progression between knowledge points through semantic analysis, and constructs a knowledge network that conforms to the internal logic of the discipline; finally, it provides visual presentation and interaction optimization. AI systems support multiple visualization forms, such as hierarchical views and relationship views, converting abstract knowledge networks into intuitive graphs. Some platforms also provide interactive functions such as node interpretation and association tracing, facilitating novice teachers to understand knowledge structures from multiple perspectives.

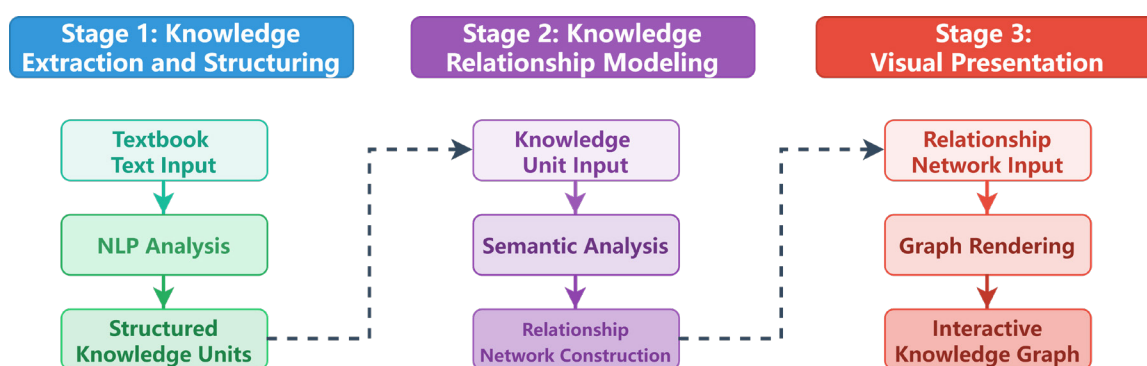


Figure 2. Knowledge graph construction process.

3.1.3. Typical application scenarios

The knowledge graph function of the VIP Smart Teaching Lesson Plan Creation Platform is quite representative. The platform adopts a four-layer architecture of “knowledge graph layer - AI analysis layer - lesson plan generation layer - resource integration layer”, realizing the visualization, traceability, and interactivity of teaching knowledge graphs, breaking the separation between knowledge graphs and lesson plan generation, and achieving the integrated connection of “knowledge sorting - teaching design”. In practical application, novice teachers only need to input “subject - grade - unit name” without complex operations. The system can quickly extract the core teaching objectives, knowledge point associations, and teaching key and difficult points of the unit through semantic analysis technology, and automatically generate a unit knowledge overview graph.

3.2. Course material collection and intelligent recommendation

3.2.1. Dilemmas of novice teachers in course material collection

Course materials are the core support for teaching design, including various types such as textbooks and teaching aids, teaching cases, question banks, and multimedia materials. Their quality and adaptability directly affect the quality of lesson preparation and classroom teaching effects. The multiple difficulties faced by novice teachers in the material collection link are important factors restricting their lesson preparation efficiency and also one of the most prominent pain points in the early stage of their employment.

Specifically, the resource collection dilemmas of novice teachers are mainly reflected in three aspects: first, resource channels are scattered. Various teaching resources are distributed on different websites and platforms. Novice teachers need to repeatedly search and switch between multiple platforms, which is time-consuming and labor-intensive. Sometimes they even spend several hours, but still cannot find suitable resources; second, resource quality is uneven. Teaching resources on the network lack unified review standards. Novice teachers cannot quickly judge the authority and applicability of resources, and are prone to using unqualified teaching resources, affecting teaching quality; third, timeliness is insufficient. Education policies, teaching concepts, and textbook versions are constantly updated. Some network resources are too outdated to adapt to current teaching requirements. Novice teachers find it difficult to efficiently obtain the latest teaching resources and academic frontier achievements, leading to lesson preparation content being out of touch with the times.

The superposition of these dilemmas makes novice teachers invest a lot of time in resource collection during lesson preparation but fail to achieve ideal results, indirectly increasing their professional pressure.

3.2.2. Technical mechanism of AI-assisted course material collection

AI technology provides a systematic solution to these dilemmas, with core mechanisms including three levels: first, semantic retrieval and intelligent matching, which is the core of improving the accuracy of resource collection. Traditional keyword retrieval methods can often only match literal meanings and cannot understand teachers' real teaching needs, leading to messy retrieval results with low relevance. However, relying on natural language processing and semantic vector matching technology, AI can deeply understand information such as retrieval keywords, teaching objectives, and learning condition descriptions input by teachers, break through the limitations of traditional keyword retrieval, achieve precise resource positioning based on semantics, quickly filter out resources highly relevant to teaching needs, and avoid invalid retrieval.

Second, learning condition analysis and personalized recommendation. Combined with the characteristics of teaching objects such as major, disciplinary foundation, and learning style, it conducts multi-dimensional modeling of teachers' teaching needs and pushes suitable resources through algorithms such as collaborative filtering recommendation; third, resource integration and secondary processing, which is an important support for improving the convenience of resource use. AI can not only complete resource retrieval and pushing, but also perform secondary processing on resources such as abstract extraction, key point induction, and format conversion according to teachers' specific needs, generating personalized resource packages that can be directly used for teaching.

3.2.3. Typical application scenarios

The course material recommendation function of the CNKI AI Intelligent Lesson Preparation System provides a mature, practical reference. The system relies on the China Basic Education Literature Resource Database, integrating massive academic papers, teaching cases, exercise resources, multimedia materials, etc. All resources have undergone professional review to ensure their authority, professionalism, and timeliness, preventing novice teachers from using unqualified resources. In practical application, novice teachers only need to input key information such as course topics, teaching objectives, and learning condition characteristics. The system can push resources that accurately match the teaching content in real time, covering various types adapted to different teaching methods and different learning conditions, for novice teachers to choose freely.

3.3. Teaching design and intelligent lesson plan generation

3.3.1. Significance of intelligent teaching design

Teaching design is the core link of lesson preparation and directly determines the effect of classroom teaching. Novice teachers generally have the problem of insufficient experience in teaching design: it is difficult to balance the three dimensions of knowledge, ability, and emotion in teaching goal setting; the connection between teaching process links is not smooth; the adaptability of teaching methods to teaching content and students' learning conditions is insufficient; the grasp of teaching key and difficult points and the prediction of students' cognitive obstacles are not accurate enough.

AI-assisted teaching design does not replace teachers' decision-making, but provides reference frameworks and optimization suggestions for novice teachers by analyzing a large number of excellent teaching cases and design rules, helping them quickly establish scientific teaching design thinking and alleviate the dilemma of insufficient experience.

3.3.2. Technical principles of intelligent lesson plan generation

Intelligent lesson plan generation relies on three core technical links (as shown in Figure 3). Each link supports the others, ensuring the professionalism and standardization of lesson plans while taking into account the personalized needs of novice teachers, achieving the organic unity of "standardization and flexibility".

First, teaching knowledge base construction, which is the basic support for intelligent lesson plan generation. The AI system integrates various resources such as pedagogy theories, curriculum standards, excellent lesson plan cases, and teaching method libraries, and establishes a structured knowledge base covering multiple dimensions such as teaching goal setting, teaching content organization, teaching method selection, teaching process design, and teaching evaluation. All content in the knowledge base has undergone professional screening and optimization, fitting the teaching reality of different school stages and different disciplines, providing scientific and professional support for lesson plan generation, and ensuring that the generated lesson plans conform to teaching laws and education policy requirements.

Second, content analysis and element extraction, which is the core link of intelligent lesson plan generation. Through natural language processing and knowledge graph technology, AI deeply analyzes information such as course topics, textbook content, student characteristics, and teaching duration input by teachers, and accurately extracts key elements of teaching design, including knowledge points, teaching key and difficult points, teaching objectives, learning condition analysis, teaching methods, etc. During the extraction process, AI will optimize and filter the extracted elements in combination with disciplinary characteristics and school stage requirements.

Third, template-based generation and personalized adaptation, which is the key link to improving the practicality of lesson plans. Based on the extracted key elements, AI automatically generates structured lesson plan content according to standard lesson plan templates, covering complete elements such as teaching objectives, teaching key and difficult points, teaching process, teaching methods, teaching evaluation, and teaching resources, ensuring the standardization of lesson plans. At the same time, the system supports personalized parameter settings such as school stage, subject, class hour length, and teaching style. Novice teachers can adjust the depth, focus, and teaching methods of lesson plans according to their own teaching needs and teaching styles, achieving personalized adaptation and making the generated lesson plans more suitable for their own teaching reality.

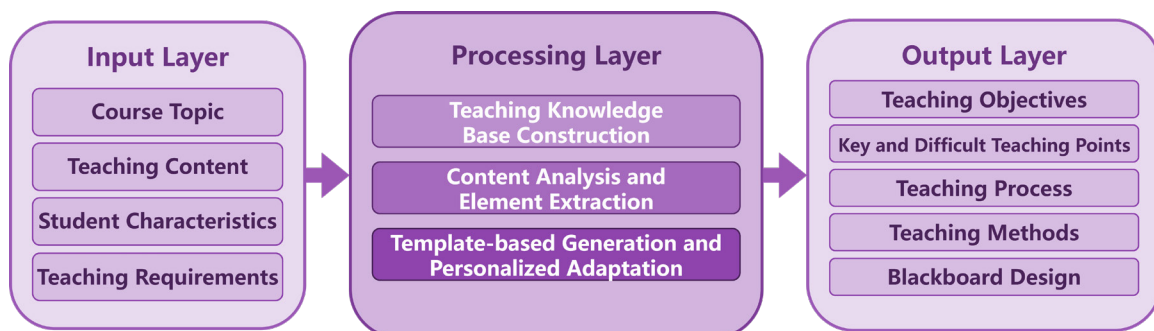


Figure 3. Intelligent lesson plan generation model.

3.3.3. Typical functions of intelligent lesson plan generation

Current mainstream AI lesson plan generation tools have formed a complete functional system. Taking Tencent Cloud AI Lesson Plan Generation Assistant as an example, based on natural language processing and knowledge graph technology, the system can analyze course content in seconds and generate professional lesson plans with complete elements. It supports adaptation to multiple school stages, multiple subjects, and multiple class hours, and can adjust content depth and teaching strategies according to students' foundations, providing efficient support for novice teachers' teaching design.

4. Conclusion

Education undertakes the mission of cultivating talents and strengthening basic education teachers. Helping novice young teachers grow is crucial for improving overall education quality. This paper explores AI-empowered teaching from the perspective of its practice and competence development, clarifying that it is an integrated measure rather than a single technology. AI-assisted teaching via knowledge graphs, intelligent resource recommendation and lesson plan generation relieves their pressure, enhances teaching and digital literacy, and helps them complete role transformation to become qualified teachers adapting to intelligent education.

Disclosure statement

The authors declare no conflict of interest.

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